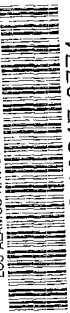




LOS ALAMOS NATIONAL LABORATORY



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the Atom

Los Alamos Scientific Laboratory

September 1977

the Atom

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FRONT COVER

Bill Jack Rodgers' front cover photo was taken during the recent visit to the Fenton Hill geothermal site by NATO scientists.

BACK COVER

To find some peace and quiet during open house of the National Security and Resources Study Center may have been the reason this young visitor is relaxing in the Center's empty conference room. This photo also was taken by Bill Jack.

LASL's Second Solar-Equipped Modular Home Built

By BARB MULKIN

LASL's second solar-equipped modular home was trucked to TA-46 late in August with little of the fanfare and press coverage that attended delivery of the first module. But Mobile-Modular II is worthy of notice, nevertheless.

For one thing, it was built within a building. For another, it was constructed by some 45 Navajo students at the Bureau of Indian Affairs Fort Wingate School near Gallup. And, finally, when complete, it may feature the largest water bed in the world to store the sun's energy.

The ultramodern structure was assembled inside the cavernous building trades shop at the school, with teams of youngsters engaged in construction from January through August. Their work was supervised by Fort Wingate teachers in a program designed by the

Scottsdale, Ariz., office of a Los Angeles-based firm, the XYZYX (pronounced Ziezicks) Information Corporation.

XYZYX specializes in designing education curricula for a variety of groups, according to Frank Siciliani, the firm's training officer in Scottsdale. "The Fort Wingate program is typical of our Native American programs," Siciliani says. "It is one of many sponsored by the U.S. Department of Labor under the Comprehensive Training Act, and it is administered by the Navajo Tribal Office of Labor under its director, Leonard Arviso."

Arviso explains that the contract between LASL and the Navajo Tribe to construct the solar home is "one of the many areas in which Los Alamos expertise may be used to fully develop both our human and natural energy resources."

Stan Moore, Q-11, solar module

"...may have a considerable impact on mobile and modular housing in the United States."

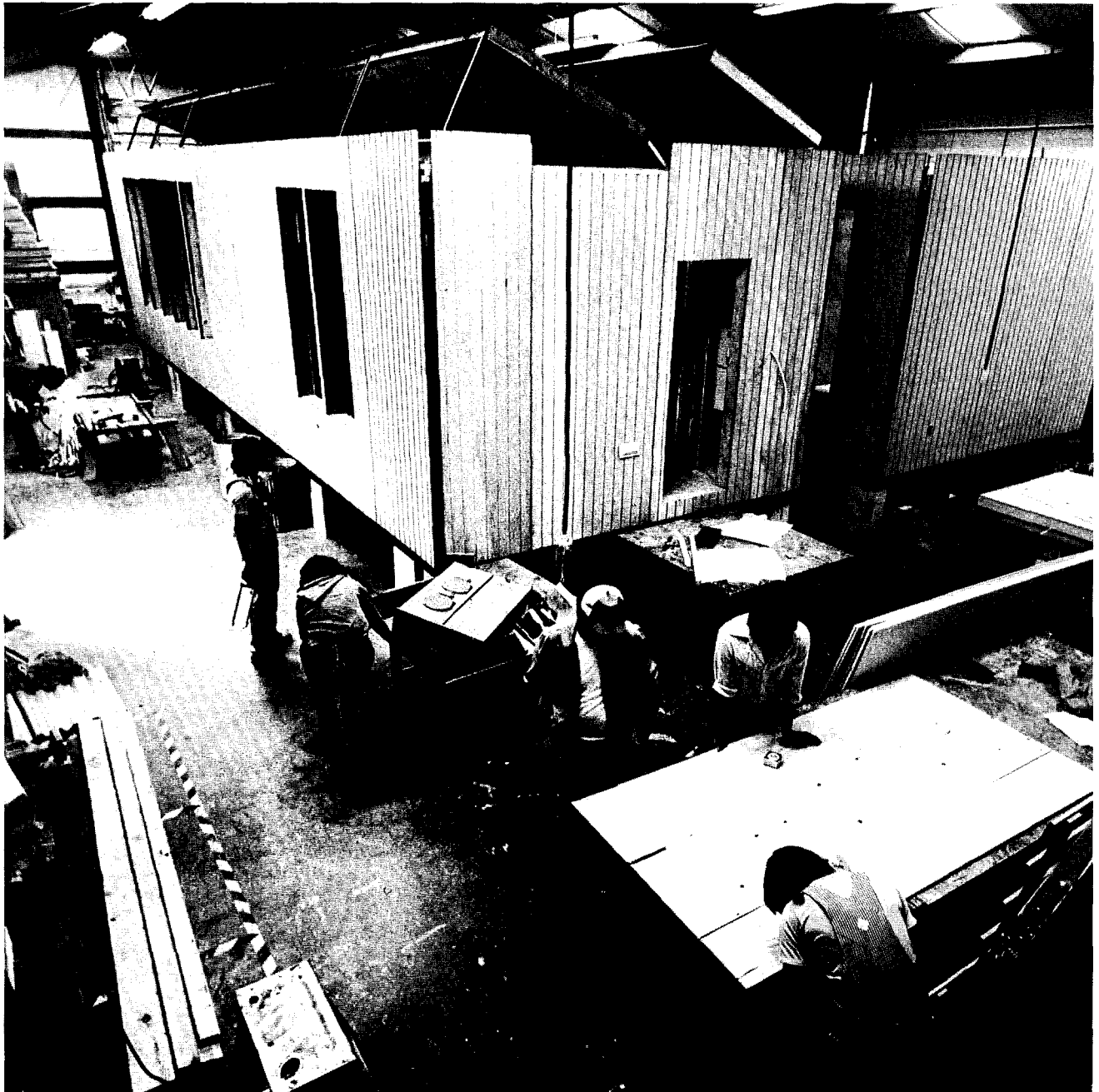
program manager, says the mobile-modular project is being funded by ERDA's Division of Solar Energy "to test and evaluate a series of prototype solar-heated and -cooled homes because the small number of manufacturers, and the ease with which solar systems can be integrated in mobile-modular units, provide a unique opportunity for immediate and large-scale reduction of domestic fossil fuel consumption at a low cost to the consumer."

LASL's first module home was constructed by an Albuquerque manufacturer. It has been used for about 2 years as office space for solar researchers, while extensive data gathering was undertaken

from its active solar system.

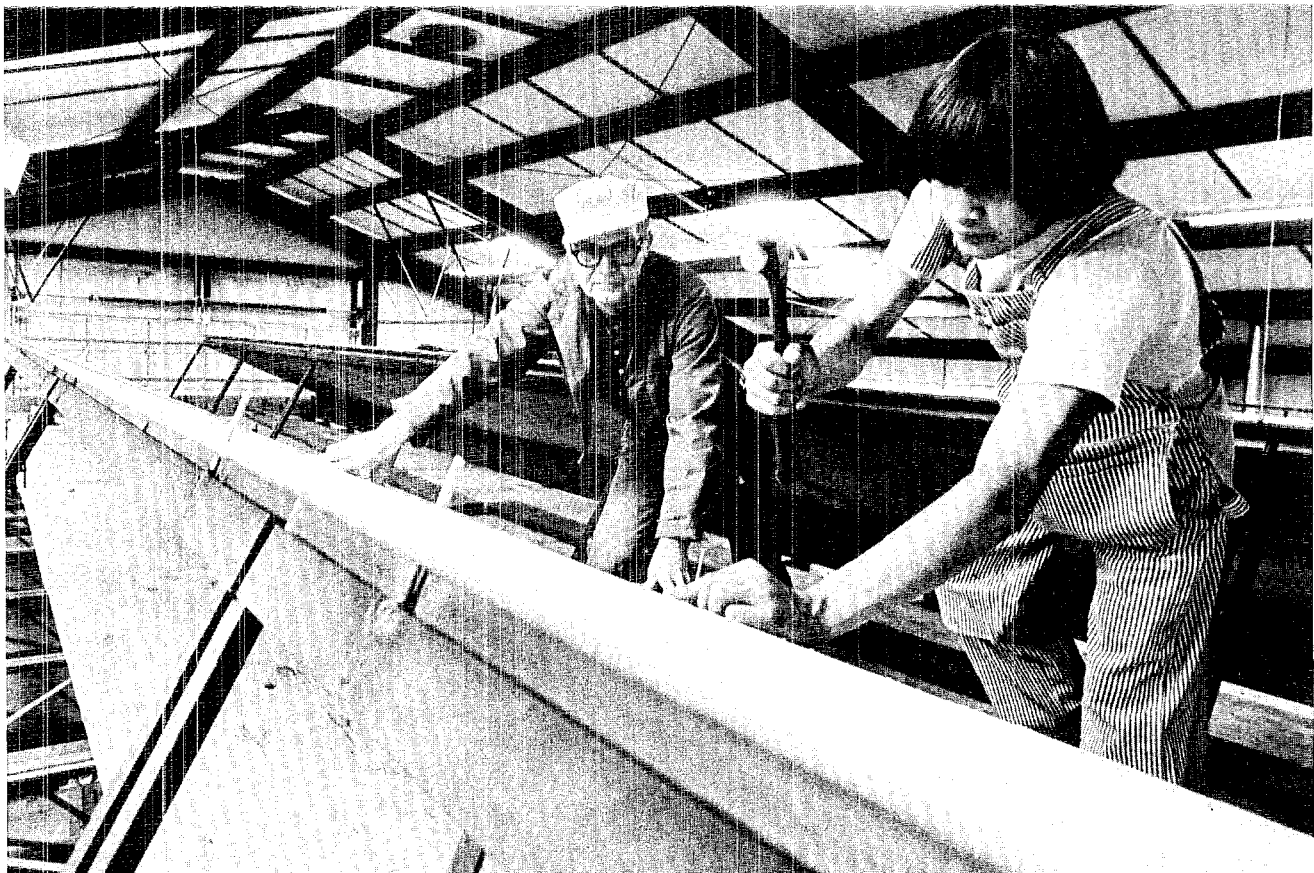
The Fort Wingate module has an unusual passive system where heat from the sun is stored in a huge (5,000-gallon) water bed formed by a series of heavy plastic bags cra-

Navajo youth at the Bureau of Indian Affairs Fort Wingate School near Gallup, N.M., built an 1,100-square-foot modular home with a passive solar heating system for LASL. The house was built in the shop trades building at the school. In this photo, the house still is under construction, but since has been trucked to LASL to be used for data-gathering on solar heating systems for manufactured housing.





The 2 Navajo youths, in the photo above, reflect intense concentration as they help construct a solar-heated modular home for LASL. They were among some 45 young people who were involved in constructing the home. In the photo below Richard Renfro of LASL's Solar Energy Research Group works with a Navajo student putting together the frame for the modular home.



dled in steel girders that line the entire ceiling of the house. Four rows of specially designed double-glazed windows form the roof of the structure. They are angled to achieve direct gain of solar radiation, by funneling the sunlight onto the water-storage units immediately under the windows. In addition, reflector panels inclined at the opposite angle to the windows, bounce sunlight through the glass for transfer to storage bags, as the sun moves across the sky.

Automatic equipment lowers panels into place to cover the storage bags to preserve the heat at night and on cloudy days. A standard electric auxiliary furnace will provide backup heat during prolonged cloudy weather.


Passive systems such as the one designed for the Navajo-built house

have the advantage of using few, if any, moving parts, such as blowers to distribute heat. They are relatively economical to construct and operate. The 1100-square-foot house, with its 3 bedrooms, 2 baths, utility room, living room, and combination dining room-kitchen, will be heated by convection and radiation—the warmth of the water in the ceiling bed will be radiated downward into each room.

The module was constructed in 2 sections, each 13 by 43 feet to satisfy transportation requirements for such homes in the United States. Double glass and heavy insulation are used to conform to the cardinal rule of solar systems: minimize the thermal load on the system. Mobile-Modular II will join the first module at TA-46 for a two-or-three year data-gathering sojourn. Both

modules may eventually be moved to a different climate to assist in assessing solar potential in areas with less incident sunshine than the Southwest.

Although the cost of LASL's solar modules is not competitive—each cost about \$40,000—Moore says that mass production (1 unit per week) could cut the cost of a unit to about \$25,000, or \$22 per square foot, a figure that represents a \$4000 to \$5000 solar add on cost compared with manufactured housing with conventional heating systems.

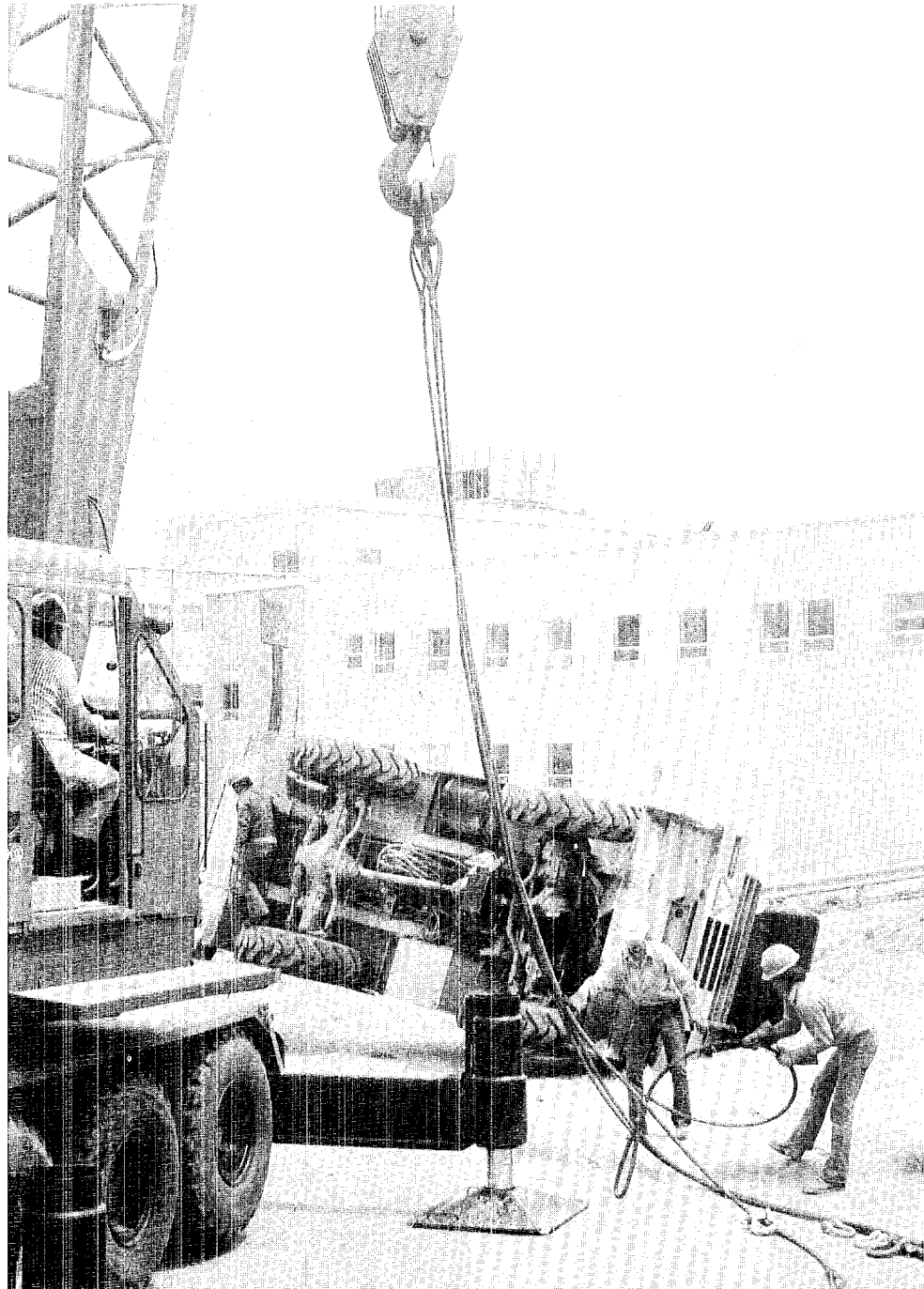
Two more modules may be constructed for LASL. They will feature heating and cooling solar systems, and, in Moore's words, "This program may have a considerable impact on mobile and modular housing in the United States." 

The new solar-equipped modular building heads for home at LASL.



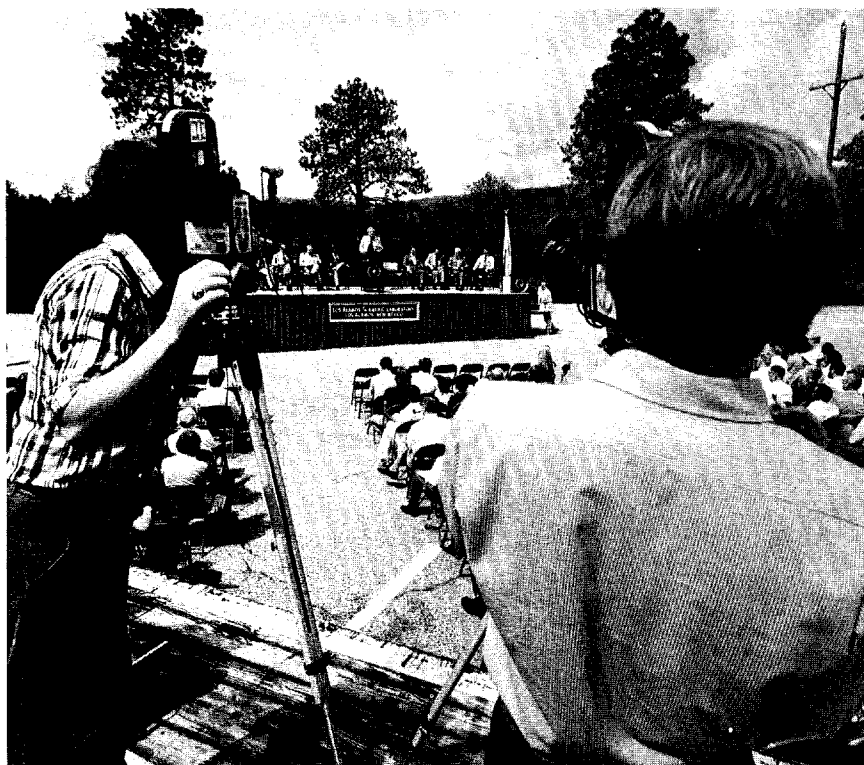
Photo Short

A small crane belonging to Zia became unbalanced and fell over in a driveway near the Administration Building recently. No one was injured, but the power of a larger crane was necessary before the damaged crane could be put back on its wheels.





U.S. Senator Pete Domenici of New Mexico was one of several speakers at the August dedication of the National Environmental Research Park, an area comprising all of Los Alamos Scientific Laboratory's 27,000 acres. A large crowd of LASL employees and the public turned out for the occasion, which was covered by local and area news people.



August 16: A Day of Ceremonies

The National Environmental Research Park dedication (page 6) and the High Energy Gas Laser Facility groundbreaking, below, brought crowds and a busy day to LASL.



Traditional groundbreaking ceremonies were held August 16 (the same day of the National Environmental Research Park dedication) at LASL for the Laboratory's \$55-million High Energy Gas Laser Facility (HEGLF). The facility, which will house a 6-module, 12-sector, 72-beam carbon-dioxide laser system named Antares, is scheduled for completion in 1982 and is funded by ERDA's Division of Laser Fusion. Pushing gold plated shovels are (left to right) Thomas R. Clark, deputy manager, ERDA Albuquerque Operations Office; J. Richard Airey, assistant director, ERDA Division of Laser Fusion; Thomas F. Stratton, HEGLF project manager, LASL; Franklin P. Durham, associate division leader, LASL Laser Research and Technology Division; Mickey Lory, LASL Laser Division; LASL Director Harold M. Agnew; U.S. Senator Pete Domenici; Maj. Gen. Edward B. Giller, USAF (Ret.), ERDA deputy assistant administrator for National Security; and Norman Fink, president, Norman Engineering Co.

The Mini-Review

A mini-review is a short article about a LASL program or project. It is written for the non-technical audience, such as legislators, agency officials, the news media, and the average reader.

The mini-review "A Typical LASL Underground Nuclear Test" is bound into this issue of **The Atom** as an example of what a mini-review should look like, how it should read, and to encourage groups throughout the Laboratory to engage in production of such articles, which are an excellent public relations and educational effort.

A short biographical sketch about the author's academic and work history and present duties at LASL may be included in the mini-review. Only one author may be listed on a mini-review.

All mini-reviews will be edited and phototype-set by ISD-6, and printing will be done by ISD-7.

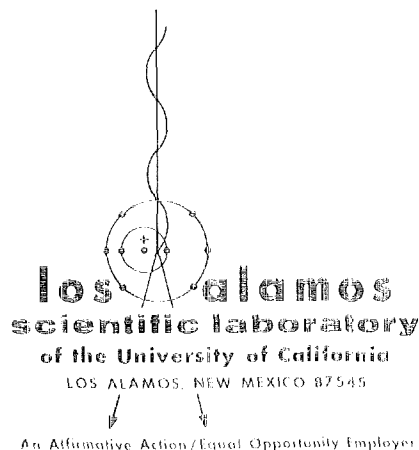
Submit a double-spaced typewritten draft and all camera-ready line drawings and photographs, together with a LASL-Series Publication Release Form (No. 894, ST-2652), through your division or department office to the ISD-6 group office, MS-184. Indicate the number of copies needed on the release form (a minimum print run of 1000 copies is suggested).



June 1977

A Typical LASL Underground Nuclear Test

Walter P. Wolff



UNITED STATES
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
CONTRACT W-7405-ENG-36

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INTRODUCTION

In support of US nuclear weapon needs, the Los Alamos Scientific Laboratory (LASL) is engaged in the design, development, and testing of nuclear explosives. Since 1963, when the Limited Test Ban Treaty was signed by the United Kingdom, the Soviet Union, and the United States, nearly all US nuclear tests have been conducted deep underground at the Nevada Test Site (NTS).

Such nuclear explosive (device) tests generally are conducted for one of two purposes:

- Weapon tests evaluate device performance. These tests usually are conducted in a vertical drilled hole.
- Effects tests evaluate the effects of device output on various critical components of missiles and warheads. These tests usually are conducted in a long horizontal pipe located deep underground in a mined tunnel.

This review describes a typical sequence of events for the weapon test of a device in a vertical drilled hole at NTS, emphasizing preparations, safety precautions, device emplacement, and detonation. Figure 1 schematically depicts the general layout for a typical weapon test.

INITIAL PREPARATIONS

The decision to conduct a nuclear test, made by a panel of senior LASL staff members, begins the complex process of theoretical design and engineering development. Because only limited numbers of such tests may be conducted, careful consideration must be given to need and priority. Approval for all such tests is staffed through the Energy Research and Development Administration (ERDA). Final detonation authority must come from the Office of the President.

After the decision to conduct a nuclear test has been made, initial preparations include the following activities.

• Diagnostic instrumentation is selected that will provide data the designers need to determine the device performance.

• The proper hole depth and diameter are determined as dictated by yield and diagnostics. Typical depths range from 600 to 3000 feet, and typical diameters range from 48 to 90 inches. Figure 2 shows a large drill bit used for drilling such holes.

• The timing, control, arming, and firing (TCA&F) system is selected.

• Design and fabrication of the diagnostic rack is started. This rack houses the device and the associated firing components, diagnostics, and instrumentation.

• The layout of the ground-zero complex is determined. This plan must consider the required electrical cables, power sources, buildings, towers, cranes, emplacement hardware, and stemming (hole-filling) material. Figure 3 shows the device firing and recording facilities near ground zero, the many cables leading from the hole, and a large crane for lowering the rack into the hole.

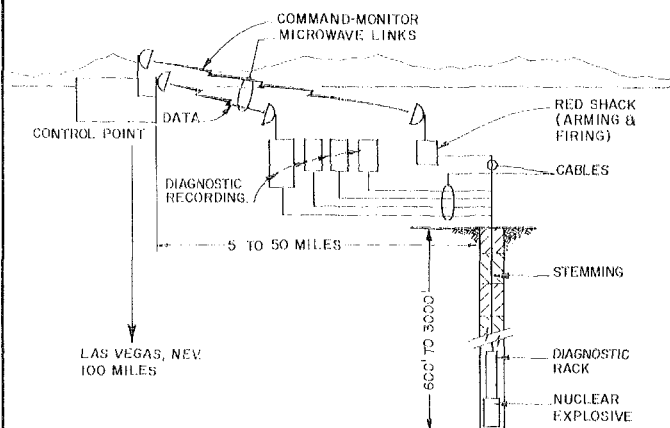


Fig. 1.

SAFETY

In addition to all the normal industrial safety considerations, two special aspects of the test are examined.

(1) The containment of all radioactive debris and gases is of primary importance for any NTS underground test. An intensive study of the geology of the drill hole and the surrounding medium is undertaken. A stemming plan is determined that includes gas blocks for electrical cables, together with the type, quantity, and placement of sand, gravel, concrete, and epoxy. All of the geological and operational information is then presented to a Containment Evaluation Panel, composed of members from several agencies, that must approve the plan.

(2) ERDA also has an established program whereby all operations involving a nuclear explosive must be approved. This approval is granted only after detailed studies of the operations are conducted by formal Nuclear Explosive Safety Study groups. Topics considered in these studies are security, assembly, storage, transportation, emplacement, stemming, control, arming, and firing.

Furthermore, all personnel who perform critical duties on the device or its firing system must have the proper training and experience and must be qualified under a Personnel Assurance program that evaluates their mental and emotional stability.

ADVANCED PREPARATIONS

The test device may be assembled at Los Alamos or at NTS, depending upon operational requirements. In either case, experienced LASL design and assembly personnel perform all of the tasks, including device placement in the diagnostic rack at ground zero. Transportation of the device or components is provided by ERDA.

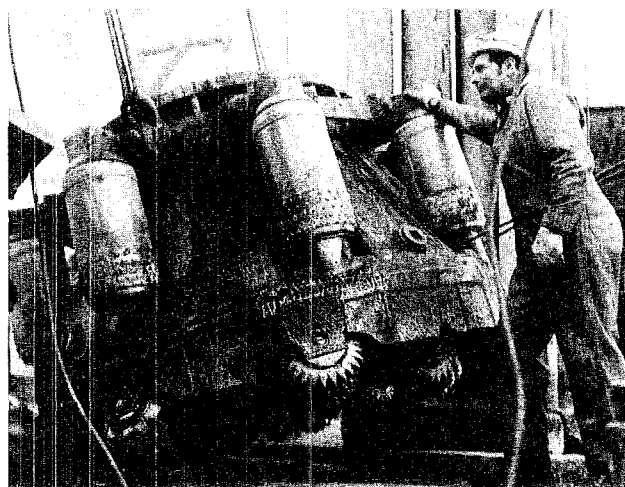


Fig. 2.

The TCA&F system is designed and operated to be reliable, rugged, and redundant, but it must also provide for the maximum in safety and control. Before any electrical connections to the device are made, the system is thoroughly tested and many dry runs are conducted to ensure complete compatibility.

Device diagnostics, which determine the various nuclear outputs of the test device, must be designed to detect and record these data before the sensors and coaxial cables are destroyed by the detonation, usually within a fraction of a millisecond. The information is sent uphole through cables to very fast optical recording devices or to digitizers for storage in a computer memory. The recording stations are only a few thousand feet from ground zero and so must be able to withstand the ground shock from the detonation. Much of the data is also transmitted by microwave to the control point (CP) several miles away for recording (see Fig. 1).

New data transmission and handling techniques involving fiber-optic bundles (to replace expensive coaxial cables) and improved digital methods are presently under development.

Engineering data such as temperature, pressure, acceleration, shock, radiation, ground motion, and seismic signals are also obtained. These data assist in equipment design, containment predictions, and effects evaluation.

OPERATIONAL SEQUENCE

Assuming proper scheduling and work progress, the device will be assembled and ready for transport to ground zero when the various systems located in the diagnostic rack are completed and fully checked out. Once the device leaves the assembly area, the time until it is placed in the

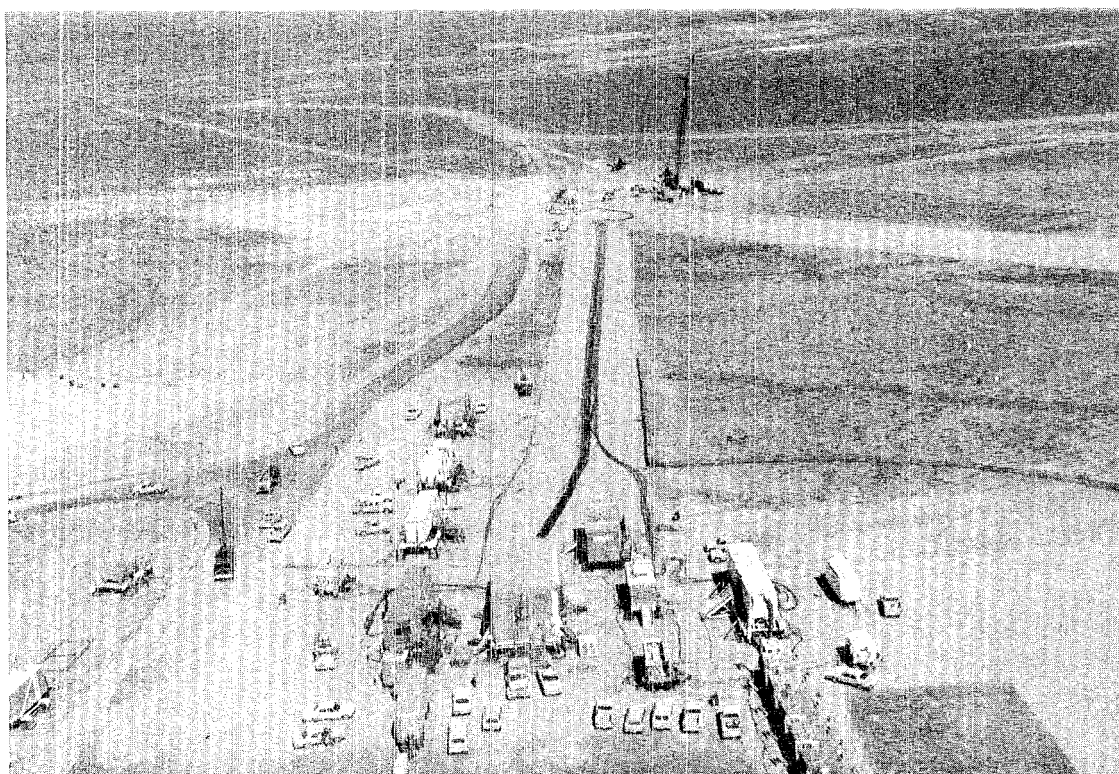


Fig. 3.

rack, lowered to the bottom of the hole, and stemmed is kept to the essential minimum.

A typical sequence of events in a weapon test is as follows.

(1) The diagnostic rack is suspended from a large crane (up to 300-ton capacity) directly over the drill hole and is readied for the device.

(2) The device is transported to ground zero in a special container and placed near the rack.

(3) The device is taken from the container, placed in the rack, and aligned with the diagnostic systems.

(4) The arming and firing system is connected to the device following detailed checklists.

(5) All systems are given a final visual check and the device and its associated components are lowered into a protective canister which is then bolted to the rack.

(6) The rack and canister are lowered to the bottom of the hole using wire rope harness and a large crane. Special care is taken to protect the nuclear explosive and the hundred or so power and signal cables.

(7) The hole is then stemmed with materials that will ensure the containment of the nuclear explosion. During this time (up to two weeks), the timing and firing system and recording systems are checked and rechecked.

(8) On the scheduled day of detonation, experts from many different agencies form a "shot panel" that will advise the ERDA Test Controller on matters of safety and

related subjects. Considerations such as weather, possible fallout of radioactive debris should there be a leak, security, damage assessment, and personnel safety are of primary importance. Figure 4 is the Operational Control Center, where the shot panel convenes.

(9) The LASL Test Director is given approval by the Test Controller to "arm the device," and the arming party makes the final connections of the arming and firing system to the downhole firing components. The arming party then returns from ground zero area to the CP several miles away. All other personnel have already been cleared from the forward area.

(10) After a final determination of acceptable weather conditions, the Test Controller gives the Test Director "permission to fire." The control signals are sent from the LASL control room (see Fig. 5) by microwave link to the "Red Shack," which houses the arming and firing equipment near ground zero.

Contrary to popular belief, there is no "pushing the button." Most signals are sent by automatic sequence that typically cycles through its program in 15 minutes. Power is turned on, coded signals are sent to "unlock" the system, and high voltage is applied to the firing unit. A final "fire signal" is sent and the device is detonated.

There is not much to see as the detonation occurs. Puffs of dust due to ground shock waves may rise from the immediate ground zero area and from nearby craters. Struc-

tures in the recording trailer park will jump and sway. In a few seconds a ground roll or two may be felt in the CP and, in the case of large-yield shots, in the high rises and casinos of Las Vegas 100 miles away.

The most spectacular occurrence may be the later collapse of the area immediately surrounding ground zero. Tremendous temperatures and pressures are generated by the energy released by the nuclear detonation, and a pool of molten earth and rock is formed deep underground in a "room" or cavity. As the temperature slowly drops, the pressure is relieved and the roof of the cavity will start to drop in, and eventually a partial chimney is formed (not extending to the surface). When the supporting strength of the earth above the chimney is exceeded by the weight of the overburden, a sudden collapse will occur and a large crater forms on the surface. It is quite a sight!

The entire test is monitored independently by teams from the US Environmental Protection Agency for off-site radiation or inadvertent release of radioactive debris. LASL's containment record has been excellent.

The test is over, but the work is only starting for the many people who will recover radioactive samples for analysis, retrieve the valuable data from their recording devices, and sort out the mass of information for the designers.



Fig. 4.

The months, even years, of planning, designing, building, and fielding of a nuclear test by the hundreds of people involved will increase our knowledge and will eventually strengthen the nuclear deterrent capabilities of our country.



Fig. 5.

Mini-Review
readers are encouraged
to correspond directly
with the author.

short subjects

Anita I. Cook, a former participant in the undergraduate cooperative program at LASL, has been awarded a \$2,500 scholarship by the Special Libraries Association in New York. She will use the scholarship to attend library school at the University of Denver. Cook was a co-op student in LASL's libraries group while attending Eastern New Mexico University where she received her B.A. in mathematics and computer sciences.

Patricia G. Rogers, a casual secretary in MP-DO, has been selected 1977 Woman of the Year for the Santa Fe Chapter of the American Business Women's Association.

Charlene Brandon, formerly Q-1 secretary, has earned the Certified Professional Secretary (CPS) designation awarded by the Institute for Certifying Secretaries. To receive the award, a candidate must sit for a 2-day examination in 6 areas of secretarial responsibility, including environmental relationships, business and public policy, economics of management, financial analysis and the mathematics of business, communications and decision making, and office procedures. Brandon, a member of the Los Alamos chapter of the National Secretaries Association, is now attending the College of Santa Fe.

Retirements: **Bethel M. Shelton**, WX-7, reproduction technician; **Joseph D. Cunningham**, SD-5, laboratory machinist; **David M. Freeborn**, SD-5, developmental machinist; **Ross D. Gardner**, CMB-1, staff member; **Alvin E. Humbyrd**, WX-3, lead operator; **Ernestine Garcia**, H-1, film badge technician; **John D. Mench**, SD-DO, model-shop foreman; **Vera L. Mench**, WX-3, property clerk; **Francis E. Stack**, SD-DO, department head; **Nicholas P. Armenis**, WX-1, staff member; **Jose L. Sanchez**, H-1, decontaminator; **Benjamin C. Diven**, P-DO, assistant division leader; **Walter E. Herkenhoff**, ENG-14, staff member.

John C. Hopkins, J-Division head, has been appointed to a 3-year membership on the Naval Studies Board, a part of the National Research

Council. The Naval Studies Board "will conduct and report upon surveys and studies in the field of scientific research and development applicable to the operation and function of the Navy."

Darlane C. Hoffman, CNC-II associate group leader, has been elected chairman of the American Chemical Society's Division of Nuclear Chemistry and Technology. The announcement was made at a meeting of the Society in Chicago the first week in September.

PATENTS

Michael D. Coburn, WX-2, was awarded U.S. Patent 4,028,154 on June 7, 1977, for an invention which relates to chemical explosives having good thermal stability. The invention concerns the compound ammonium 2, 4,5-trinitroimidazole, which the inventor says has explosive performance comparable to that of RDX, but a thermal stability which is significantly better.

Stanley W. Moore, Q-11, was awarded U.S. Patent 4,010,733 on March 8, 1977, for an invention concerning a flat plate solar heat collector unit. The solar collector is integrated as a structural unit so that the collector also functions as the building roof. The functions of efficient heat collection, liquid coolant flow passages, roof structural support and building insulation are combined into one unit.

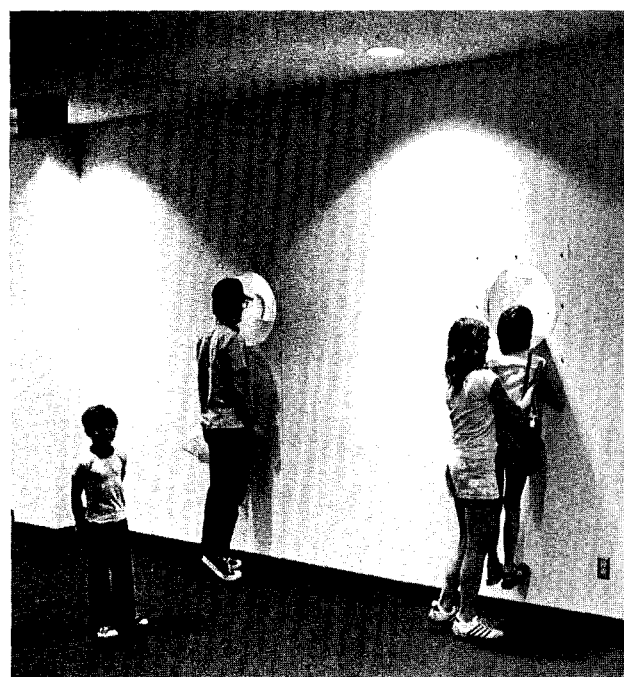
Theodore M. Benzinger, WX-2, was awarded U.S. Patent 4,032,377 on June 28, 1977, for a method for the production of high-purity triaminotrinitrobenzene. The abstract states that triaminotrinitrobenzene is readily formed by the nitration of 1,3,5-trichlorobenzene to 1,3,5-trichloro-2,4,6-trinitrobenzene followed by amination to triaminotrinitrobenzene. The purity of the triaminotrinitrobenzene is significantly improved if, during the amination step, sufficient water is present that the byproduct ammonium chloride formed during the amination is rendered at least semideliquescent.

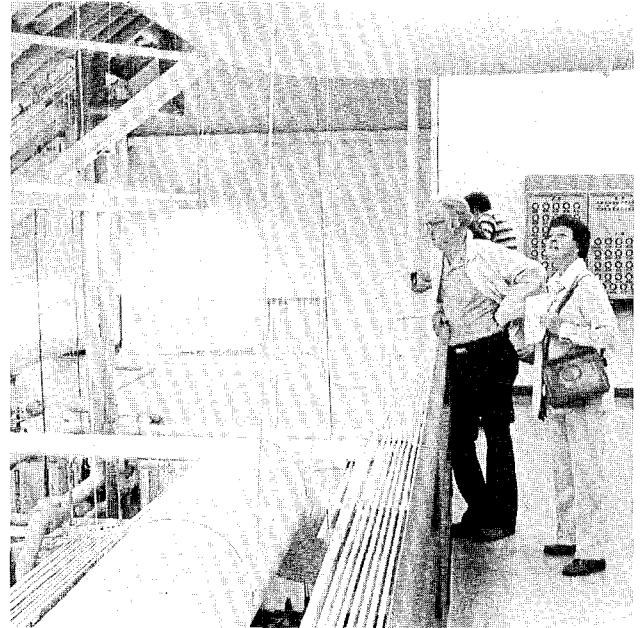




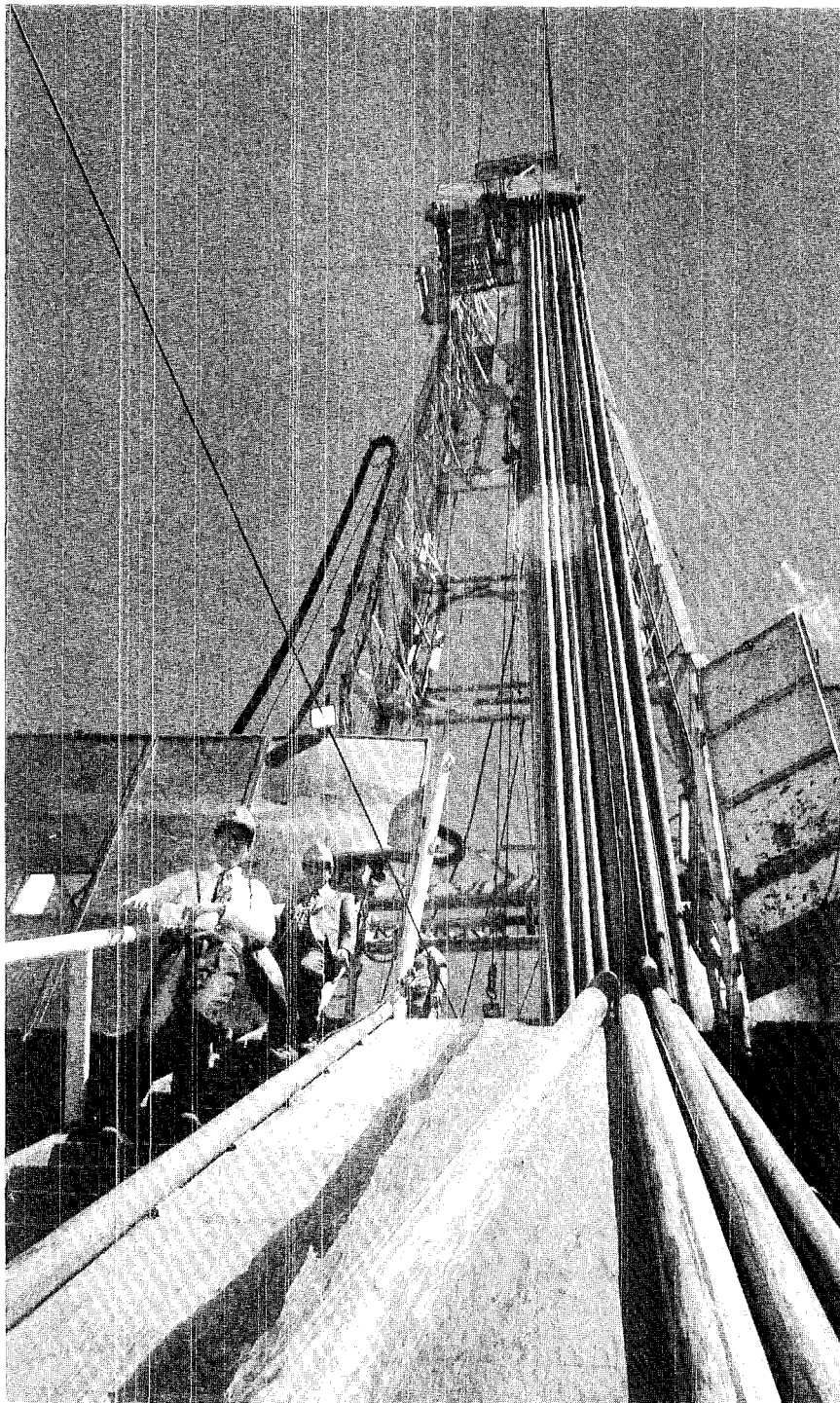
NSRSC Open House

The National Security and Resources Study Center was opened to LASL, ERDA, Zia and EG&G employees and their families and area residents on Sunday, June 26. The NSRSC had been open to Laboratory users for some time, but the public had a chance during the open house to see what the \$4.6-million Study Center contains. Visitors, in the photo above, receive information in the Center's main lobby. Below, a little extra effort is required to make it possible for a young person to view the solar heating and cooling facilities of the NSRSC. In the top photo on the following page, people browse through the technical journal section of the Center's library, and in the far right photo visitors get a close look at solar heating and cooling facilities. The bottom right photo shows individual study areas. ❀





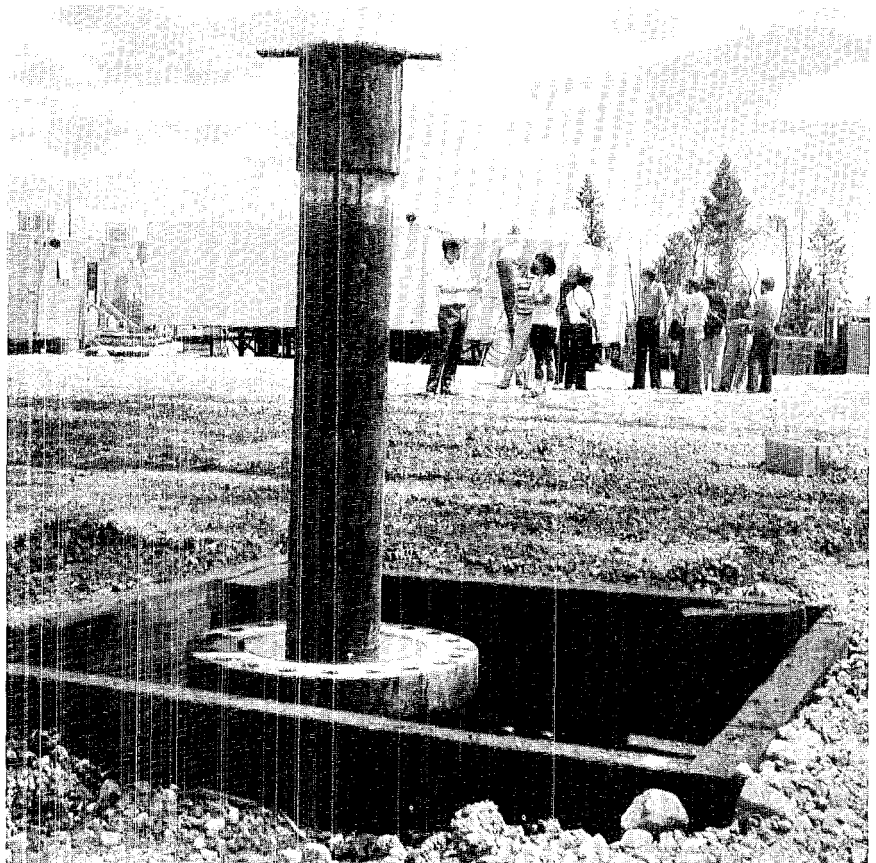
Among Our Guests



Two Japanese members of the International Atomic Energy Agency visited LASL recently and are shown descending the ladder leading to the drilling platform at LASL's geothermal well at Fenton Hill.



Al Blair, standing, alternate G-Division leader, and Bob Brownlee, right, G-Division head, discuss geothermal energy with Dick Burdett, a technical assistant on the staff of U.S. Senator Harrison Schmitt of New Mexico.



Members of NATO's Committee on Challenges of Modern Society visited geothermal well sites at Fenton Hill recently. Their tour of LASL's geothermal experiment climaxed several days of meetings on hot dry rock geothermal potential.

Grass Seeds Spread Over Burned Areas

An extensive reseeding effort has been made to try to prevent erosion and further destruction of soil and plant life in the 15,000-acre area near Los Alamos charred during the June La Mesa forest fire.

About 10 pounds of 6 native grass seeds per acre were spread over more than 15,000 acres between July 8 and July 17. A helicopter service from Fort Collins, Colorado, flew over the burned areas and spread the seeds.

A U.S. Forest Service official reports that the reseeded has been successful in all but the most severely burned areas.

Participating in the reseeding efforts were personnel from ERDA, the Forest Service and the Park Service.

In the photo below, a helicopter prepares to take off with a load of grass seeds, and in the photo at right flies over charred trees near Los Alamos.








Harry Dreicer

Dreicer Will Head CTR Division

Harry Dreicer, a staff member at LASL for 23 years, has been named head of the Laboratory's CTR Division.

Dreicer received his B.S. in physics in 1951 and his Ph.D. in physics in 1954—both from the Massachusetts Institute of Technology. He joined the staff of LASL shortly after graduation from MIT, and became group leader of the plasma physics research group in 1966. He was holding this post at the time of his appointment to head the CTR Division. 

10

years ago in los alamos

Culled from the September, 1967 files of The Atom and the
Los Alamos Monitor by Robert Y. Porton

NATO ASSIGNMENT

Robert G. Shreffler, a physicist at the Los Alamos Scientific Laboratory, will spend the next 2 years working for the North Atlantic Treaty Organization in Brussels, Belgium. Schreffler, alternate W-Division leader at LASL, will be on a leave of absence while at NATO. In his new post he will be Director of the Nuclear Planning Directorate responsible to the Secretary General of NATO.

STUDENTS LEAVE SCHOOL

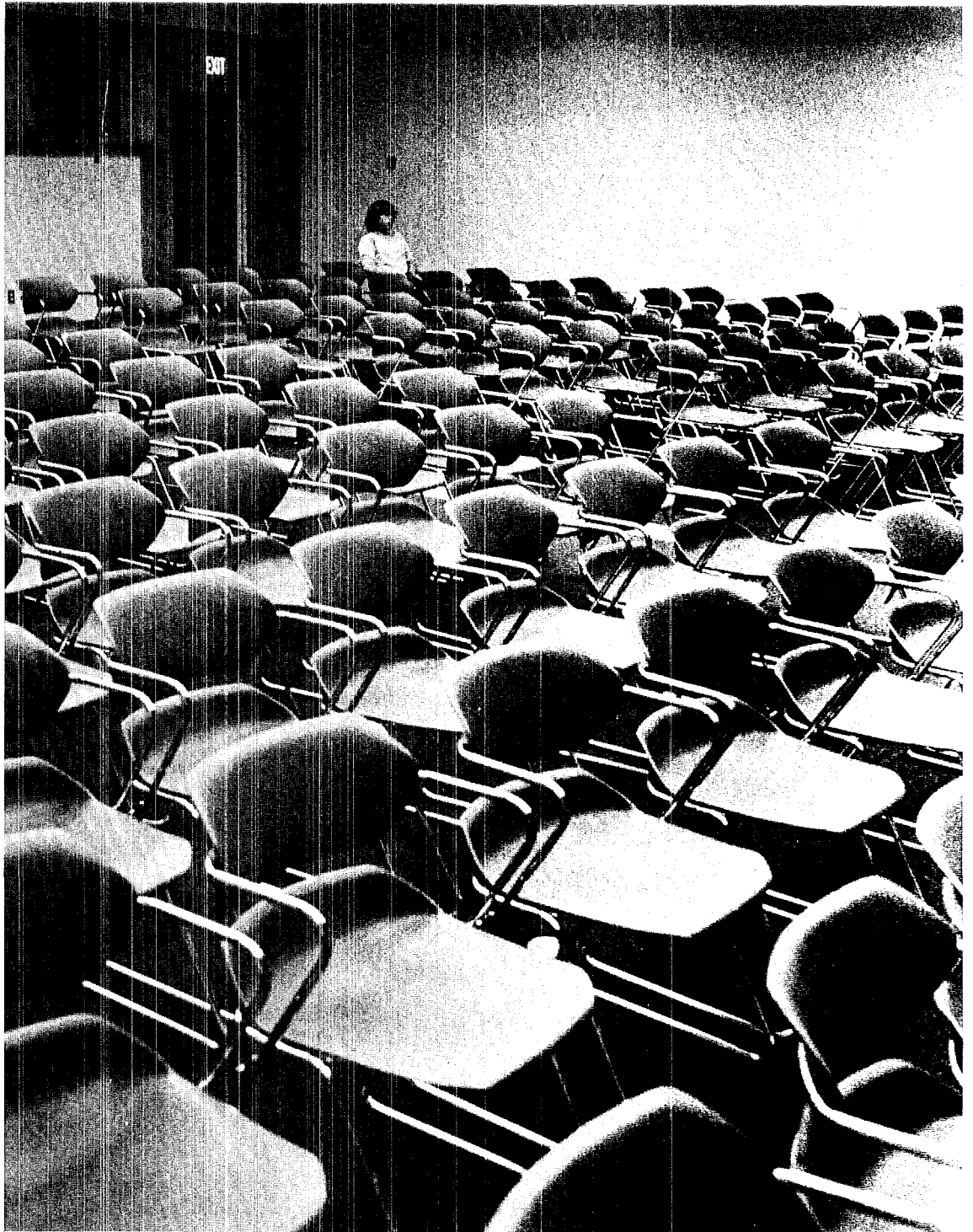
High school principal Robert Loar told the Los Alamos County Board of Educational Trustees that some male students have apparently dropped out of school rather than cut their long hair. The high school administration, said Loar, is enforcing dress standards that prohibit long, unkempt hair for boys and extremely short skirts for girls.

UHTREX GOES CRITICAL

A new research tool was added to LASL's power reactor division when UHTREX (Ultra High Temperature Reactor Experiment) reached criticality. Full power experimentation, part of the Atomic Energy Commission's program for developing high temperature gas cooled reactors which use helium as the coolant and graphite as the neutron moderator, will benefit the commercial nuclear power industry, according to K-Division leader David Hall. It has long been recognized that there is a significant chance for reduction in power reactor costs with high temperature gas cooled reactors.

HOUSING!

Members of the Subcommittee on Communities of the Joint Committee on Atomic Energy of the Congress met in Los Alamos last week to hear testimony on multi-family housing disposal in Los Alamos. Members participating included Senator Wallace Bennett of Utah, Representative Craig Hosmer of California and Subcommittee Chairman Representative Thomas Morris of New Mexico.



Early or late? Neither, actually. This young man ventured into a conference room in the National Security and Resources Study Center during an open house of the facility recently. Perhaps the tranquility of the room offered a chance to relax.